

TITLE

VERSATILE AND ERGONOMIC HEAT-DISSIPATING STAND FOR
ATTACHMENT TO PORTABLE COMPUTERS

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(0001) CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority of Provisional Application Number 60/414,035,
filed 09/27/2002.

(0002) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
DEVELOPMENT:

Not Applicable.

(0003) REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER

(0004) PROGRAM LISTING COMPACT DISK APPENDIX:

Not Applicable.

(0005) BACKGROUND OF THE INVENTION

(0006) Field of the invention.

(0007) The present invention relates to a portable stand device to support notebook computers on an incline/raised angle towards the computer operator for improved viewing, keyboard ergonomics, to increase airflow to the base of the notebook computer, and to promote convection-type heat dissipation, thereby reducing heat retention in the notebook computer. Also, the present invention retains the mobility, handling and versatility of the host laptop computer.

(0008) Description of prior art.

(0009) Notebook computers can generate substantial heat in their lower cases as a byproduct of their operation, i.e. processor, hard drive, optical drive and battery charging and discharging. This heat can be reflected back towards the notebook computer when used on a flat or soft/cushioned surface with insufficient airflow and/or this heat can be transmitted towards the operator's body when the notebook computer is placed on the operator's lap.

(00010) Also, with increasingly faster processors, faster hard drives and higher capacity batteries, laptop computers can generate a noticeable amount of heat internally. Many laptop computers have an internal heat sink and / or electric fan. When the temperature inside the computer reaches a preset limit, a fan is activated to increase air flow over the internal heat sink to reduce the internal temperature. These heat sinks are designed to transfer the heat, generated by the internal components, to the computer's exterior cases where it can be absorbed into the surrounding airflow. Such power-using means to dissipate excessive computer-generated heat can decrease the total time of use on a single battery charge for a personal laptop-type computer.

(00011) Also, when using a portable computer on soft surfaces, i.e. carpeting, bed cover or pillow, the air gap underneath the computer is restricted or diminished, causing hot spots on the bottom case of the computer. On models equipped with an internal electric fan, this condition usually triggers the fans activation, consuming additional battery power. Some types of counter tops and

desktops using a laminated construction, even though they have a hard, flat surface, can reflect enough heat back into the lower case to generate hot spots and trigger the fans activation.

(00012) Stands have been proposed that provide an improved air gap for increased cooling of the laptop computer. Some proposed stands also angled the keyboard for improved ergonomics while typing. However, the stands lack efficient mobility in their designs, i.e. some are bulky and require disassembly to be transported, and some are designed for specific models of laptop computers, thus are not compatible with other models. Many designs are impractical and are actually a hindrance to the goals and concepts of mobile computing. Examples of published references in the field of laptop computer supports and stands include US20020003197 A1, US20010003961 A1, US6164213 A1, US5871094 A1, US5470041 A1, US5722624 A1, US6115249, US5503361, US5915661, US5899421, US5337985, and US4852498.

(00013) Even considering the disclosure in these references, there exists a need for a stand that provides increased cooling effects, improved ergonomics and the same usefulness, fast handling and the mobility of the portable computer itself. The presently described invention provides an elegant and versatile portable computer stand device that satisfies this need, and advances the art.

(00014) All patents, patent applications, publications, texts and references discussed or cited herein are understood to be incorporated by reference to the same extent as if each individual publication or patent application was specifically

and individually set forth in its entirety. In addition, all references, patents, applications, and other documents cited in an Invention Disclosure Statement, Examiner's Summary of Cited References, or otherwise entered into the file history of this application are taken to be incorporated by reference into this specification for the benefit of later applications claiming priority to this application. Finally, all terms not specifically defined are first taken to have the meaning given through usage in this disclosure, and if no such meaning is inferable, their normal meaning.

(00015) BRIEF SUMMARY OF THE INVENTION

(00016) The present invention addresses the above-noted criteria, increased cooling effects, improved ergonomics and the same usefulness, fast handling and the mobility of the portable computer itself, by providing a vented stand base that is connected to a hinged leg to raise and support the laptop computer on an angle/incline for improved cooling at the bottom/base of the laptop computer. In certain embodiments, this stand base is made from aluminum alloy to help cool the laptop computer by absorbing and dissipating heat away from the base of the laptop computer, (i.e. heat-sink characteristics). Furthermore the angle/incline of the laptop computer's keyboard and palm-rests produced by this configuration improves the alignment of the hand-wrist-forearm for improved ergonomics. In contrast to many existing base devices, the present invention satisfies the above criteria while maintaining a compactness that permits portability of the portable personal computer, with the present invention device attached thereto that is comparable to

the portability of the portable personal computer by itself. Thus, in at least some instances, depending on the size of a carrying case, a portable personal computer with the present invention device attached can be carried in such carrying case. This precludes the need to carry separately the stand device of the present invention.

(00017) The present invention uses Velcro™ disks and/or vinyl grip/support pads to locate and/or attach to the base of the laptop computer. This configuration allows the present invention to have a semi-permanent attachment to the base of the laptop computer. This attached configuration allows the present invention to be conveniently carried, used and stowed with the laptop computer at all times.

This configuration also provides added protection to the base of the laptop computer from impact damage by placing the alloy base/tray of the present invention between the laptop computer and any harmful obstacles.

(00018) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

(00019) The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and, together with the description, explain the invention.

(00020) In the drawings:

(00021) FIG. 1 is an exploded view of an exemplary laptop stand consistent with the present invention.

(00022) FIG. 2 is a rear/side lower oblique view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the opened/extended

position with a laptop computer in the opened position.

(00023) FIG. 2A is a rear/side lower oblique view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the closed/stowed position with a laptop computer in the closed position.

(00024) FIG. 2B is a side view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the opened/extended position with a laptop computer in the opened position.

(00025) FIG. 2C is a side view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the closed/stowed position with a laptop computer in the closed position.

(00026) DETAILED DESCRIPTION OF THE INVENTION

(00027) The following discussion of the figures is meant to be illustrative, and not limiting, of the present invention.

(00028) FIG. 1 provides an exploded view of one embodiment of the laptop stand of the present invention. A stand base, Fig. 1A, is also referred to herein as a heat-conductive planar member. This planar member is dimensioned to conform with the footprint of the bottom side of said personal computer. For example, in one specific embodiment, this is dimensioned to conform with what is known in the art as a 14-inch laptop computer (e.g., having a footprint, i.e., the dimensions defined by the rubber feet on such laptop computer) of about 10.5" inches wide by 8.5" inches from front to back). With the heat-conductive planar member, Fig. 1 A, having dimensions approximating this footprint, the laptop stand device actually can be used to support

and cool 12-inch laptop computers, and also can be used to support and cool larger units, such as 15" and 16" laptop computers. In the latter cases the side and/or back edges of the computer would overhang the stand device.

(00029) Advantageously, said planar member is substantially comprised of a material with a specific thermal conductivity between 50 and 300 W/m•K, and more specifically, within any of the following ranges: 50 and 100 W/m•K; 60 and 90 W/m; 60 and 75 W/m; 200 and 300 W/m; 220 and 280 W/m; and 240 and 270 W/m. In one embodiment, an aluminum alloy, known generally in the art as 6061-T6 is used to substantially comprise the planar member and the stand leg. By substantially is meant at least 40 percent of total weight, and more specifically is meant at least 60 percent of total weight, and even more specifically is meant at least 80 percent of total weight of the planar member (or other part of the stand device). Alternately, other metal alloys having a specific thermal conductivity (defined as the thermal conductivity divided by the specific gravity of the material) in one of the above ranges are used.

(00030) It also is recognized that non-metallic materials, such as certain non-metallic foams and composite materials (the latter, including, but not limited to carbon/epoxy graphite composites, and carbon/epoxy/fiber composites), are suitable for use to comprise all or a portion of the planar member. For instance, not to be limiting, a mesophase pitch-derived graphitic foam is reported to have a density between 0.2 and 0.6 g/cm³, and a bulk thermal conductivity between 40 and 80 W/m•K (Klett & McMillan, Heat Exchangers for Heavy Vehicles Using

High Thermal Conductivity Graphite Foams, ORNL 2000-01-2207). The properties of this material as reported by the distributor, Poco Graphite, Inc., are reported to be 0.5 g/cm^3 , and a bulk thermal conductivity of $130 \text{ W/m}\cdot\text{K}$. Using these latter values, this results in a calculated specific thermal conductivity of about $260 \text{ W}\cdot\text{cm}^3/\text{g}\cdot\text{m}\cdot\text{K}$.

(00031) Other materials utilizable to comprise all or a portion of the planar member are metallic foams and composite and engineered materials from these foams. Aluminum-based foams are one type of such metallic foams.

(00032) On the top surface of the planar member is at least one retaining means. The function of the retaining means is, via friction and/or a positive attachment, to maintain a desired positioning of the planar member with respect to the bottom side of said personal computer. In its simplest form, such retaining means is unitary with the actual surface; for instance, not to be limiting, the retaining means is a texturized non-slip finish, such as is formed in certain baked-on powder coat finish methods. Other types of retaining means, which may be used in combination with one another and the surface characteristics of the planar member, include, but are not limited to: hook and loop type (e.g., Velcro®), Fig. 1F, attachments adhered at selected points on said planar member (and at corresponding locations on the bottom side of the computer; one or more vinyl pads positioned on the top surface of said planar member; stretchable straps from points on said planar member, an elevated lip at or near the front top edge of said planar member; and, spanning one or more sections of said personal computer. Regarding the latter, one example is flexible bands of

material (i.e., latex rubber) that are affixed near the corners of the stand device that are stretched to wrap around the respective corner of the computer when the computer is set in place atop the stand device.

(00033) Another element of the device depicted in Figure 1 is a hingedly attached retractable stand leg, Fig. 1B. This is attached toward the rear edge of the planar member, and is disposed for elevating said rear edge when in an extended position. As better viewed in Figure 2, the stand leg, Fig. 1B, is hingedly attached by means of a threaded fastener, Fig. 1D, threaded into a press-fit tension nut, Fig. 1E. Optionally, as shown in Figure 2, a vinyl-edged protector, Fig. 1C, is slipped over, glued, or otherwise affixed to the bottom edges of the two feet, Fig. 1B. Similarly, a linear vinyl-edged protector, Fig. 1G, is slipped over, glued, or otherwise affixed to the front bottom edges of the planar member, Fig. 1A. It is noted that the actual shape of the stand leg(s), and the number of stand legs, may be varied, yet the device is still within the spirit and scope of the present invention. Likewise, the use of hinging and rotational means may vary within the range of mechanisms known to those of ordinary skill in the art, and the presence of the vinyl-edged protectors is optional. The leg stand also may be detachable, and/or attached by means other than a hinged attachment means. Finally, the number, placement, and actual shape of the vinyl-edged protectors may be varied, yet the device is still within the spirit and scope of the present invention.

(00034) Another aspect of the stand device is that either upward-directed bumps,

points, other shapes, or ridges (collectively referred to as "ridges" hereafter and in the claims) on the planar member top surface, and/or the thickness of the selected retaining means, provide a gap between the bottom surface of the laptop-type computer and the majority of the surface area of the top surface of the planar member. This gap is for passage of air between the bottom side and the planar member, such passage of air increases the heat dissipation from said personal laptop-style computer during its operation.

(00035) Also, it is noted that in some embodiments, retaining ridges are used to maintain a desired positioning of the planar member with respect to the bottom side of said personal computer. For instance, stepped ridges, with the smaller steps closer to the center of the planar member, are molded or otherwise fabricated or added to the corners of the planar member. These stepped ridges form a right angle at each corner, and the corner of a typically sized personal laptop computer fits within one of the sets of the stepped ridges. This retains the computer in place on the planar member of the stand device. In other embodiments using retaining ridges, only a single ridge is in each corner (e.g., they are not stepped, or "nested"), and in other embodiments a bottom edge ridge, combined with top corner "right angle-shaped" ridges, are employed.

(00036) It is also noted that voids in the plane of the planar member are provided to also promote ventilation. A balance among such voids, the gap distance, and the mass of the heat-absorbing material comprising the planar member is reached during the design of various embodiments of the presently described

invention. This balancing may consider one or more of the following factors: the normal placement of heat-generating components in the personal laptop computer; the normal placement of the most heat-sensitive components in the personal laptop computer; the desired weight of the stand device; and the durability, impact absorption, cost, thermal conductivity, and density of materials used in the stand device.

(00037) Thus, in certain situations, based on the type of laptop computer (and its base configuration and size), and the model of the stand device of the present invention, the relative location of the laptop's own support pad or base might not conform with the stand device. This may be because a large laptop extends beyond the dimension of the stand device planar member, the laptop's support pad(s) lie(s) over a void (such as a longitudinal slot, an upward-directed ridge of the stand device projects against the laptop bottom in such a way that the laptop's own support pad does not contact the planar member, or for other similar reasons. A solution in such situations, in order to assure a good contact between the laptop and the stand device, is to utilize one or more support pads, attachable at appropriate points to the stand device, where such support pads have sufficient total height (thickness) to 1) provide the physical linkage between the laptop and the stand device, and 2) to provide a desired air gap between the respective planar surfaces of the laptop and the stand device. Kits in which such pads are provided with the stand device are included within the scope of this invention.

(00038) It also is noted that the tilt angle of the stand device, which typically is due to the height of the stand leg when in the extended (not folded) position, is variable in some embodiments. This variability in certain of these embodiments is provided by incorporating a stand leg, or separate legs, that are adjustable in height. Such adjustable stand legs are adjustable by mechanical means known to those of ordinary skill in the art, including, but not limited to: a first portion slidable against a second portion, where both portions are in linear alignment, with a set screw to tighten at a desired position a circular or elliptical disk having at its periphery feet, pads or flattened areas at different distances from a central axis, wherein at that axis the disk is rotably engaged in relation to a section of a stand leg downward-extending from the stand base, and upon securing this connection (which, in some embodiments, may be done by a screw, or by an inner spring loading that biases against the rotation, and with slots and ridges on opposing faces of the disk and section intersecting at designated specific positions) at different positions of the disk in relation to the section, different heights are achieved; and two or more telescoping legs adjustable by a tightening nut (as used on a camera tripod). Design and performance criteria, as well as aesthetics, are balanced to provide suitable adjustable leg designs for different embodiments of the stand device.

(00039) FIG. 2 is a rear/side lower oblique view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the opened/extended position with a laptop computer in the opened position. This figure particularly

shows the positioning of the stand leg, Fig.1B, in the open position, and the placement of the long vinyl edge protector, Fig.1G, along the front bottom-directed edge of the planar member (where it provides friction/stabilization and scratch-prevention functions).

(00040) FIG. 2A is a rear/side lower oblique view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the closed/stowed position with a laptop computer in the closed position.

(00041) FIG. 2B is a side view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the opened/extended position with a laptop computer in the opened position. A side view depictive of several types of retaining means is shown, Fig. 1F.

(00042) FIG. 2C is a side view of an exemplary laptop stand consistent with the present invention in FIG. 1, shown in the closed/stowed position with a laptop computer in the closed position.

(00043) One embodiment of the present invention, sized approximately 12.0 inches wide by 10.0 inches from the front to back edges, is ready to use with most laptops. However, for those laptops that have a footprint that does not match the surface shape of an embodiment of the present invention, four vinyl support pads, each approximately .5" in diameter, can be used to adapt the surfaces to conform suitably. The four adhesive backed vinyl support pads are attached in the corner areas of the embodiment to support and grip the laptop securely to the embodiment. This also maintains a gap between the surfaces of approximately, .187" to .062"

inches, and preferably between .125" and .094" inches, which permits air flow to dissipate heat (which is in addition to the heat absorbed by the stand base, (also referred to as the heat-conductive planar member).

(00044) Alternately, by using hook and loop disks (for instance, of 1.00 inches in diameter, and made using Velcro™ material), the laptop computer bottom is semi-permanently attached to the top of the stand device. This configuration provides additional benefits by keeping the stand device with the laptop-type computer at all times. This configuration also keeps the bottom case of the computer covered by the stand base of the present invention device. This provides extra protection against impacts to the bottom case of the computer when in use or while being carried in a case or backpack.

(00045) In this regard, it is noted that metallic foams and graphite foams, and other structurally sufficient foams, may provide superior impact cushioning per unit weight than metals and metal alloys. As costs decrease for these foams, it is expected that their popularity as a material in the stand devices of the present invention will increase. Also, the use of cushioning pads, hook and loop, vinyl and other attachment means, and the adhesive itself on such pads and means, add to the impact tolerance when used in the stand devices of the present invention.

(00046) Also, one of the design criterion of the present invention is to provide improvements to the keyboard ergonomics. This is accomplished by elevating the back of the computer to a height that helps align the hand, wrist and forearm. By

tilting the back of the computer upward, the hands and wrists don't have to bend downward across the palm rests producing pressure in the wrist area, and can maintain a straighter alignment to the forearm. By improving this alignment the computer operator should experience less typing fatigue during extended typing operations.

(00047) Also by tilting the computer towards the operator, keyboard visibility is increased, a benefit to those users who are not touch typists, and the computers LCD screen is elevated higher, lessening the downward view angle and reducing neck strain.

(00048) For all of the thermal conductivity and specific thermal conductivity values herein, including in the claims, it is assumed that these values are at a standard room temperature between about 20 and 25 degrees Celsius.

(00049) For the above variations and in other regards, it should be understood that the examples and embodiments described herein are for illustrative purposes only and that various modifications or changes in light thereof will be suggested to persons skilled in the art and are to be included within the spirit and purview of this application and the scope of the appended claims. Clearly, the dimensions of the stand device and associated components, as modified by those of ordinary skill in the art, falls within the scope of the invention described and claimed herein. Likewise, the exact make-up of the components of the stand device may be varied to attain desired physical, performance and aesthetic characteristics, and still fall within the scope of the invention described and

claimed herein.

(00050) Also, although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included in the scope of this invention as defined in the following claims. In the claims, means-plus-function clauses and step-plus-function clauses are intended to cover the structures described herein as performing the recited function and to cover not only structural equivalents, but also to cover equivalent structures. Thus, although a nail and a screw may not be equivalent structures in that a nail employs a cylindrical surface to secure wooden parts together, whereas a screw employs a helical surface, in the environment of fastening wood parts, a nail and a screw may be equivalent structures.